AN INVENTION OF Engines of Motion

LATELY

Brought to perfection.

WHEREBY

May be dispatched any work now done in ENGLAND or elsewhere, (especially VVorks that require strength and swiftness) either by *Wind*, *Water*, *Cattel* or *Men*.

AND

That with better accomodation, and more profit then by any thing hitherto known and used.

LONDON,
Printed by *I. C.* for *Richard Woodnoth* next door to the *Golden heart*, In Leaden-Hall-street.
1651.

Samuel Hartlib

A

PASSAGE

Out of the

Lord VERULAN's

Novum Organon,

Tranſlated out of *Latine*.

THe Introduction of Noble Inventions ſeemeth to be the very chief of all humane actions, which former Ages ſufficiently witneſſed; in as much as they attributed Divine Honours to ſuch Inventors, whereas they alotted only the Honour or Title of Heroes to the well-deſerving in civil Affaires; ſuch as are the Founders of Cities and Empires, Law-makers, the deliverers of their Countrey from long and tedious miſchiefs, the ſuppreſſions of Tyrannies, and the like. And truly, whoſoever ſhall well ſcan the matter, he ſhall find this verdict of the auncients to be very juſt. For the benefits of new Inventions may extend to all an-

kind universally; but the good of civil atchievements can respect but some particular Cantons of men: these latter do not endure above a few ages, the former for ever. Moreover, the Reformation of States in civil affairs for the most part, is not compassed without violence and disturbances: But Inventions make all men happy without either injury or dammage to any one single person. Furthermore, new Inventions are as it were new Creations, and Imitations of Gods own works.

Again, it were good to take notice of the vertue, efficacy, and consequences of Inventions, which ar escarce more conspicuous in any then in these 3. unknown to to the Auncients, and whose beginnings (although but of late) are obscure and unrenowned, to wit, the Art of Printing, Gunpowder, and the Marriners Needle. For these three have changed the face and state of things throughout the whole world. The first in the matter of Learning, the second in that of War, and the last in Navigation: From whence have followed an innumerable change of things, so that no Empire, no Sect, nor no Constellation seemeth to have had a greater influence upon humane affairs then these Mechanical Inventions have had.

A LETTER TO Mr. Samuel Hartlib,

CONCERNING

An Invention of Engines of Motion lately brought to perfection.

SIR,

WHereas by the bleſſing of God, who only is the giver of every good and perfect gift, while I was ſearching after that which many far before me in all humane learning have ſought, but not yet found, (*viz.*) a Perpetual Motion or ſelfmotion, or a leſſoning the diſtance between ſtrength & time; though I ſay not that I have yet fully obtained the thing it ſelf, yet I have advanced ſo near it, that already I can with the ſtrength or help of 4. men, do any work which is done in *England*, whether by wind, water, or horſes, as the grinding of *Wheat*, *Rape*, or raiſing of waters: Not by any power or wiſdom of mine own, but by Gods aſſiſtance, and (I humbly hope after a ſort) immediate direction, I have been guided in that ſearch to tread in another path, then ever any other man that I can hear

or reade of, did tread before me, yet with so good succes that I have already erected one little Engine or great Model at *Lambath*, able to give sufficient demonstration to either Artist or any other person, that my Invention is as useful and beneficial (let others say upon proof how much more) as any other way of working hitherto known or used.

Having therefore brought it to the birth, I confess I am pained to be delivered; but want the help of some good Neighbours, or rather the Child being indeed born, and that kind and faithful Office performed by your self, without whose help as the chief Instrument, I could hardly have brought it forth. The next care is for a good Nurse, lest the Infant perish for want of timely nourishment. And this also I hope to obtain by your farther negotiation and assistance, that so this talent may not be hid under a Bushel, but be imparted for the general use of Mankind, & for the comfort of all that Family, to whom this so hopeful an issue doth belong. I must confess ingenuously, that if God as the efficient cause, and your self as his proper Instrument, had not (in a manner alone) supported and encouraged both my spirit & hands from time to time, there would have been little or nothing of it extant at this time, if the undertaking had not quite miscarried, so good a Nurse have you been both to me and it. This (dear Sir) I speak the rather, that I may encourage you through the love of God to every good and laudable purpose, not to grow weary in your mind, notwithstanding that infinite corruption you meet in the wayes of men to stop your course, but to continue still as hitherto you have done in a course of patient well-doing, and to cast your bread upon many waters; for assuredly of this

seed

ſeed you will reap an abundant Harveſt in due time, if you faint not; And if this age ſhould not reſent ſo gratefully as they ought, all the labours of your love; which you have, and I know more and more intend to expreſs by the grace of God, for the univerſal good of the whole Nation: yet Poſterity perhaps may, when they ſhall conſider how inſtrumental you have been not only to contribute to the building of many Colledges of Piety and Learning; but alſo to ſet forwards the beſt meanes, that can be held forth to any induſtrious or ingenious people, of livelihood and outward riches, by a reformed way of Husbandry: Of which that of ſaving and multiplying Corn is one of the chief and moſt ſubſtantial parts.

As for the Invention formerly mentioned, of better and more accomodate wayes of grinding, my purpoſe is not (at preſent) to enlarge my ſelf therein, nor mention thoſe very many uſes for which they are to be fitted; but only to intimate the goodneſs of theſe kind of Engines, as they ſtand compared to other common Mills, by a ſhort meaſuring ſcale here incloſed. And to I commend you to Gods favour and bleſſing, as alſo my ſelf and the whole buſineſs, which is the continued prayer of

Sir,

March the 10.
1651.

Your moſt faithful and obliged
Friend and humbleſt
Servant.

A Scale to measure the Uses and profits of my Engine by as it stands compared with others. All commonly known Causes of strong and swift Motion are concluded under these 6. heads.

Springs	Men	Water
Weights	Wind	Horses.

FOr the first, two *viz. Springs* and *Weights*, they are rather used for *Watches*, or *Clocks*, or *Jacks*, then for *Mill-works*, and are therefore not necessary to be taken notice of here.

For the third, *viz.* Men, they are used for strong Motions often; but those motions are slowe, as craining up of Goods or the like, and as for *Mill-works*, they are only used for grinding of small quantities of Malt, in those Engines, commonly called *Quernes* or *Hand-Mills*, and for turning of grinding-Stones, and for hand-Pumps which make but small riddance.

For the fourth *viz. Wind*, this is used in great and strong *Mill-works*, as for the grinding of Corn or Rape, *&c.* for sawing of Timber, or for draining of drowned Lands, *&c.* But these Wind-Mills are liable to these Inconveniencies.

First, they are only to be erected upon Hills, or open plains, and therefore not useful in all places.

Secondly, they are not without some danger of being broken, and that not the Sailes only, (which though frequent are mendable) but sometimes to be torn in peeces, yea tumbled quite down by violent and suddain storms, which (though it happen but seldom) yet in respect it may so be, and in respect of the great losse, both

both of life and goods that neceſſarily followes, there is ſufficient argument to deterre any man from building ſuch Mills where others (leſſe hazardous) can be ſet up. Though not to neglect the uſe of them, where no other can be had.

Thirdly, ſuch ſtorms and guſtie winds, though they alwayes break not the whole Mill nor its ſails, yet it often compels it to ſtand ſtill, or if it go it grinds untowardly, ſomtimes too high, preſently too low, and is apt to heat, &c. And the ſame makes the deale-boards that are ſawed by ſuch Mills ſo ruffe and ſhagged, from hence alſo it is that in drayning works of this nature, the tackling is very apt to break.

Fourthly, Calmes are all the year long, and eſpecially in Summer ſo frequent, that upon enquiry, I am confident it will appeare that moſt Wind-Mills ſtand ſtill above half the year, though not altogether at one time. And for this cauſe no man will grind at a Windmil, that can as conveniently grind at a Water-Mill; And he may have griſt when the wind ſerves not, or want when the wind ſerves.

Fifthly, The Cog-wheels in moſt Wind-Mills are (in the diameter) 8. foot or under (I take the example from one of the beſt Wind-Mills in Moore-fields, which I think is not much inferiour to any in *England*) the trundle is at the leaſt two foot, which is 4. to one. Now I have obſerved in a pretty ſtiffe gale, that the ſailes, and conſequently the Cog-wheele hath gone about 8. times in a minute, that is 24. turnes in a minute for the ſtones: And for the moſt part of the time they work, it is not much above this rate, which cannot diſpatch above 3. buſhels in one houre, but a good Mill of mine may grind a quarter.

The 5th. principle of Motion is Water, or the Water-Mills: These also are lyable to some inconveniences.

First, if the foundation be not carefully and skilfully laid, all is in danger to be eradicated.

Secondly, if the banks of the dam break, the water runs the wrong way.

Thirdly, in great floods she stirs not.

Fourthly, in droughts in Summer most VVater-Mils want water.

Fifthly, not one of a hundred hath water at any time of the year to serve day and night too, unlesse they go very weakly and to dispatch but little.

Sixtly, he that will erect a VVater-Mill is bound to set it up where Nature hath provided a sufficient streame, and cannot have one elsewhere upon any termes.

Lastly, (although VVater-Mills be of all other the best yetknown or used yet) onewith the other through *England*, will not grind above foure bushells in an hour; whereas a good Mil of mine wil (as is aforesaid) grind a quarter or more; therefore hath a manifest advantage of all other Mills, and especially in this, that the profit and charge of mine are present or absent together, so that no custom or profit, not a penny charge.

The Sixt and last Principle of Motion is the Horse-Mill, (I have heard they use Oxen in the Barbadoes) These (though weaker then wind, or VVater-Mills) are the best, for so much as they can do, in respect they may be set up, and made use of almost at all times and places, and are lyable to some defects or inconveniences, though fewer then the other.

First,

First, If any or all the Horſes dye or be dangerouſly ſick, the dead horſe what ever he coſt or was worth, is clearly loſt to the Maſter, and the ſick muſt be ſupplyed, and maintained idle till recovered.

Secondly, (and this is the only moſt conſiderable defect or difference, between mine and this, and that is a great one indred) The horſe Mill is abſolutely incapable of being carried on to the grinding of Corne or ſuch ſtrong wrks: For, The Brewers Mills (the beſt or greateſt, I mean now uſed in *London*) move by the ſtrength of 4 horſes under a wheele of 24 foot diameter, which may contain at 4 Inches pitch 216 Cogs, the horſes path is not above 18 foot, ſo that the Cog-wheel over-hangs one further part, theſe Horſe: one time with another, draw not above 112 pound weight apiece at moſt, and move (at moſt) 3 times about in a minute, the whole ſtrength of the 4 is 448: out of which deduct one 4th. part, there remains 336. And 216 Cogs is 648. Cogs at work in a minute, theſe work upon a ſtone of 4 foot it may be 4. and a halfe, by a trundle of one foot, or 9 ſtaves at the ſame pitch, (if of 10 ſtaves it goes ſtronger but ſlower) by this account 72 is the reſpective nnmber of turnes, the ſtone runs about in a minute.

Note that if this Mill were to grind Wheat with the ſame ſtone, it could not move by this trundle, nor with this ſterngth, and a larger trundle would not turn the ſtone ſo oft in a minute, whereas my Engine prepared for Wheat, will bring at leaſt twice ſo much ſtrength with the Cogs, yet turne the ſtone at leaſt 72 times in a minute.

Let this ſerve as a Scale to meaſure all other Appli-

cations by; for what ever wil hold in grinding Wheat, will hold (to give the advantage to my Engines) much more in any other Application, and particularly for Grinding or ſqueeſing of Sugar-Canes, and raiſing water; for which laſt I have an Invention yet to come far above this or any thing hitherto knowne (as I at leaſt) humbly conceave.)

Another Letter to Mr. Samuel Hartlib, *concerning the forementioned Invention.*

SIR,

Here withall preſent you with a Liſt of ſome of the Uſes or Applications, for which theſe Engines are fit (for it is very difficult, if not impoſſible, to name or find them all at the ſame time) *viz.*

To grind Malt or hard Corne,
To grind Seed for the making of Oyle.
To grind Colours for Potters, Painters or Glaſſe-houſes.
To grind Bark for Tanners.
To grind Woods for Dyers.
To grind Spices or Snuffe-Tobacco.
To grind Brick, Tile, Stones, or Earth for plaſter.
To grind Sugar-Canes.
To draw up Coales, Stones, Ure or the like, or Materialls for great and high buildings.
To draw Wyre.
To draw water from Mines.
To draw water from Meers or Fens.
To draw water to ſerve Cities, Townes, Caſtles, &c.
To draw up water to flood dry grounds, or to water grounds.

To

To draw or hale ſhips, boats, &c. up Rivers againſt the ſtream.
To draw Carts, Wagons, &c. as faſt without Cattel.
To draw the Plough without Cattel to the ſame diſpatch if need be.
To brake Hemp, Flax, &c.
To beat Hemp, Flax, &c.
To weigh Anchors with leſs trouble and ſooner.
To ſpin Cordage, or Cables.
To bolt meale faſter and finer.
To ſaw ſtone.
To ſaw Timber.
To polliſh any ſtones, or Mettalls.
To turne any great works in wood, Stone, Mettals, &c. that could hardly be done before.
To file much cheaper in all great works.
To bore Wood, Stone, Mettalls.
To thrash Corne if need be.
To winnow Corne at all times, better, cheaper, &c.
For Paper-Mills, Thread-Mills, Iron-Mills,
Plate-Mills, *Cum multis aliis, &c.*

Having thus according to your commands given you an accompt in part of theſe things; give me leave by way of repetition to give you as it wer an abridgement of this whole buſineſſe for a cloſe; that ſo you may in a cloſer order review what pertection God hath brought this work unto; to the intent we may the more rejoyce in and admire his goodneſſe, & the more admire but lament the dulneſſe of this preſent Age, in which there is ſo few that will pull their hands out of their boſoms to receive ſo great bleſſings. The happy ſucceſſe of my Endeavours have arrived at this.

To chooſe the beſt ground, or fitteſt for the then preſent purpoſe, which if it be already good and rich enough, 'tis well; but if not, To know not only all the Common ſorts of Dung, Manures, or Compoſts,

with their Common uſes, but divers others perhaps of better uſe, and a diſtinct and better uſe of thoſe already known (in a word) ſo as that out of any twenty Acres in *England*, that lyes together, and is in any degree of goodneſſe, to take right good and ſufficient Compoſt for that 20. Acres, and that from generation to generation, & that in ſuch a ſort that the ground ſhall be continually rather improved and of more profit thereby, if the owners will themſelves; and alſo to the great eaſe of many parts of *England*, where their tillage Lands lye far from home; To make two loads of Dung or other Compoſt more effectuall then ten is now. This Land thus choſen and ſoyled, to plough after a better and more advantageous manner, with cattel, or if need be, to plough or dig without cattel as cheap, and as faſt as now; (this is more advantage to the Publique then the Private, though no loſſe to any.) To ſow, or rather to ſet or plant in a way ſo much ſuperiour and more advantageous then the common way as is hard to beleeve. This Land thus ſowed, ſet, or planted, to manage the Crop when above ground yet more to a double advantage by wayes not formerly known or hardly thought on.

The Crop thus come up to be inned, and preſerved till thraſhed with more ſafety; and if Barely, &c. being malted to dry better and far cheaper, if hard corne to grind by virtue of the Engines or Mills aboveſaid, if Rape-ſeed or the like to grind and make into oyle, if Hemp or Flax, &c. to brake and beat, &c. And for Corn, to thraſh if need be, with leſſe charge and more expedition far, but this I will never conſent to make common till I perceive that there is other wayes actually on foot to ſet the poore on work, or that we want hands to diſpatch our neceſſary buſineſſe. The

The Corn however thraſht to winnow great quantities without ſtaying for the wind as ſome doe, or without taking a whole family from all other imployments as others doe, and without thoſe many loſſes, charges, inconveniences that attend this buſineſſe too commonly throughout *England*, yet ſhal the corn be cleaner dreſt by much: and that ſo ſeaſonably to anſwer your own deſires, which is very often fruſtrated in the uſefull way, eſpecially where there is great quantities: The charge to every great Corne-Maſter will not be great to erect or prepare, but the benefit much more then he himſelfe thinkes of, or will eaſily beleeve till experience hath indeared him to it; for a taſt, conſider what advantage it will be (after preparation made) to keep your corne in the chaffe, free from Hogs or Hens, or two-legged or foure-handed Thieves, &c. free from the danger of heating or growing as long as you pleaſe, and at an hours warning to make purely cleane as little or as much as you pleaſe, without any more then one perſon engaged, except for very great quantities, and then but two at moſt, and that but for a while; from hence we can for a need draw it without cattell into the field to ſowe, or into the Market to ſel; and ſo this double invention never forſakes the good husband, till his hands be quit of it till next year, or for ever.

And if any ground be over-flowed againſt the owners will, or to his hurt, the Engine is ready to dreſſe it and lay it dry; or if too dry by nature to flood it; or if too dry by accident, that is by drought, to water it, morning or evening as there is cauſe with more eaſe, leſſe charge, and a more regular way by farre, then any Garden is watred, ſo ſhall thy Crop flou-

riſh

riſh when thy neighbours (that takes not the ſame courſe) haſ fade away. And in ground that affords any Coale-pits, or other deep Mines, it will take them up with more eaſe, ſpeed, and leſſe charge; or if you build a ſtately houſe, the Engine will much facilitate the work both in reſpect of time and charge.

Finally, By the bleſſing of the ſame God, there are begotten by the ſame Father Induſtry, and conceived by the ſame Mother Ingenuity, ſome other offſprings of no ſmall or leſſe uſe; in order to the preſervation of the Lives and Eſtates of very many thouſands; from or in the moſt common and eminent dangers, and to perſwade and prevaile with the Sea alſo, to diſcloſe and impart her treaſury whether her own naturally, or that of which ſhe hath robbed us.

But firſt let us ſee what kind entertainment the world will give to theſe before any others ſhew themſelves. If the Land be converted to paſture for Sheep, the Engine will full the cloath.

If for a dayry, it will churn the cream into butter.

If to feed or breed cattell, it will grind bark that tans the skins.

And if for planting and nouriſhing of Timber, the ſame Engine will ſaw it to great gaine and advantage.

Thus you ſee there is ſo neere an allyance between theſe two Inventions, and both ſo agree to aſsiſt and reward the good Husband, that there is no eſſentiall part of Husbandry, wherein they do not naturally aſsiſt each other more or leſſe. I remaine alwayes

SIR, *Your moſt faithfull and obliged*
July the 18. 1651. *Friend to ſerve you.*

FINIS.